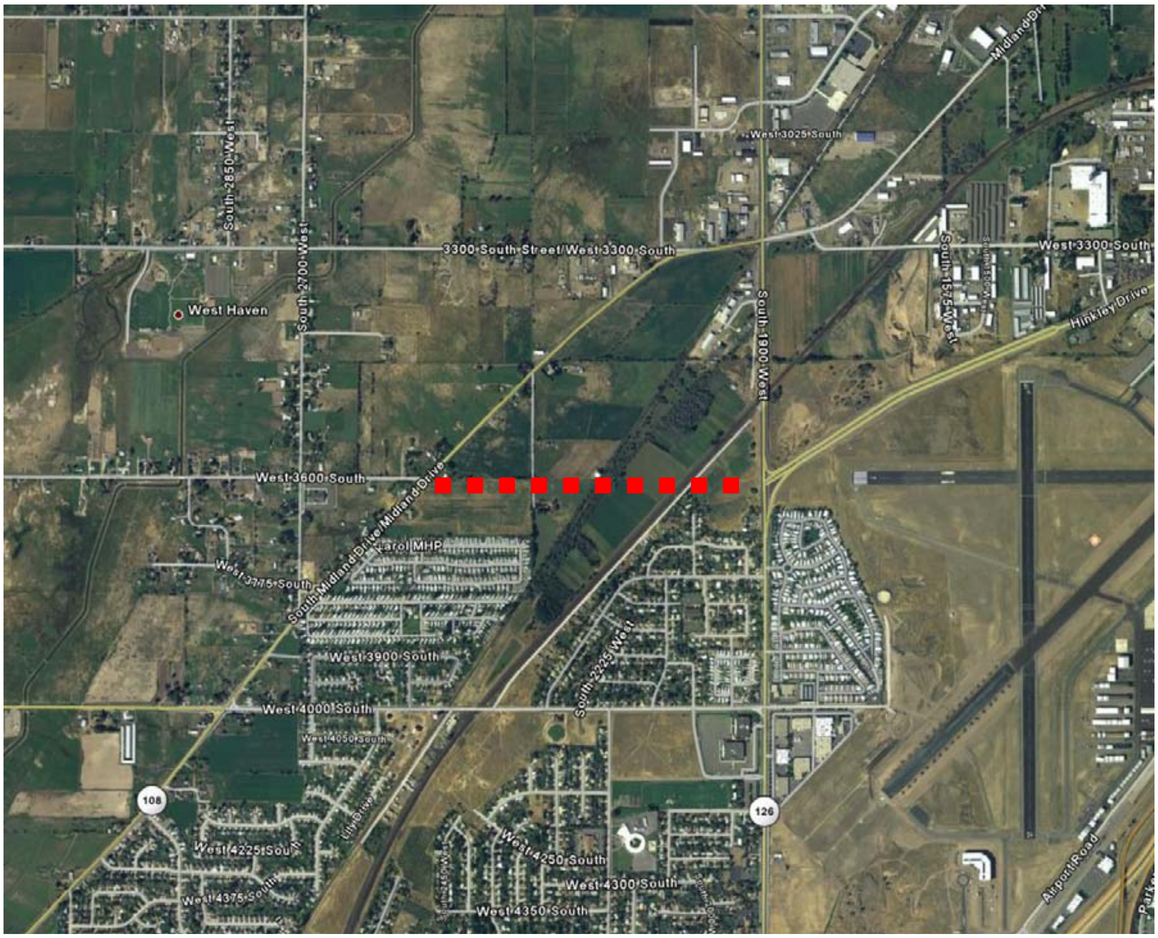
Appendix A

Traffic Analysis

SR-79 Hinckley Drive Extension Traffic Analysis

UDOT Project Number: STP-0079(2)0
UDOT Pin: 2578



January 2008

UDOT Traffic Management Division

UDOT CONNECTING COMMUNITIES

Introduction

Design considerations concerning safety, grade of alignment and traffic flow have prompted UDOT to request an additional traffic analysis for the Hinckley Drive Environmental Assessment (EA) Preferred Alternative alignment at the Hinckley Drive / Midland Drive intersection. This report analyzes the traffic characteristics of the proposed changes to the preferred alignment and examines the traffic arguments for and against the proposed changes. The study includes operational analysis at 5 intersections, hereafter referred to as the study intersections. The study intersections are listed below and shown in Figure 1:

- SR-126 (1900 West) / SR-108 (Midland Drive)
- SR-126 (1900 West) / SR-79 (Hinckley Drive)
- SR-37 (4000 South) / SR-126 (1900 West)
- SR-108 (Midland Drive) / 3600 South (on future Hinckley Drive alignment)
- SR-37 (4000 South) / SR-108 (Midland Drive)

The suggested changes are to the Hinckley Drive / Midland Drive intersection. The prior EA had a preferred alternative that did not connect Hinckley Drive through east to west. This report examines whether it makes sense to connect Hinckley Drive through from east to west with a signalized intersection at the Hinckley Drive / Midland Drive / 3600 South intersection. Figure 2 shows alternatives schematically.

This analysis examines the 3 alternatives that have new volume projections:

- 2030 No Build
- 2030 Midland / Hinckley Divided Intersection (Prior EA preferred alternative)
- 2030 Midland / Hinckley Signalized (Full movement intersection at Midland Drive / Hinckley Drive)

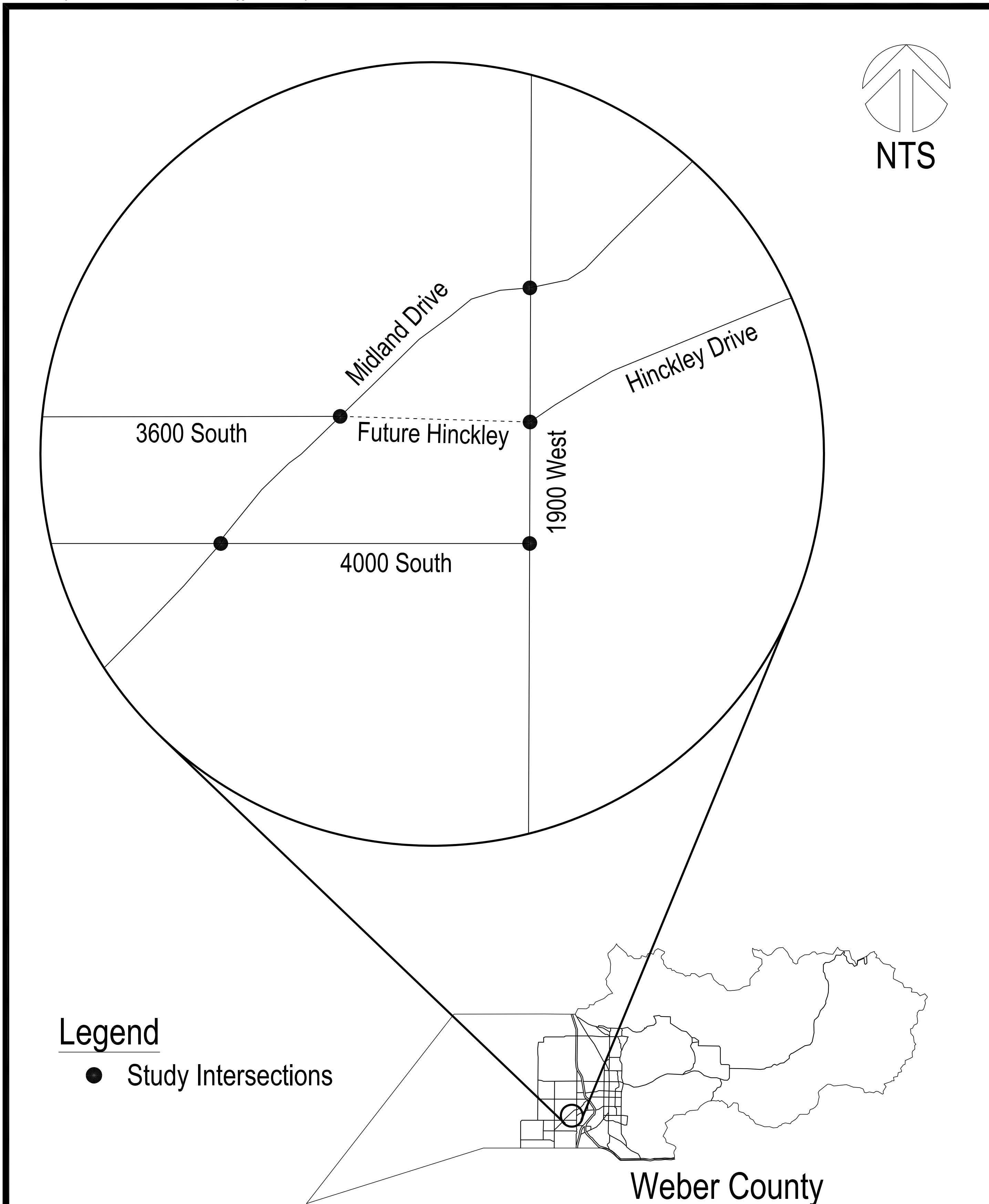
We have presented the volumes for two additional scenarios for comparison purposes. These scenarios present volumes for comparison, but no operational analysis.

- 2007 Existing Conditions
- 2030 Prior EA Preferred Alternative (prior volumes from 2002 traffic study)

The remainder of the report describes the analysis methodology and results.

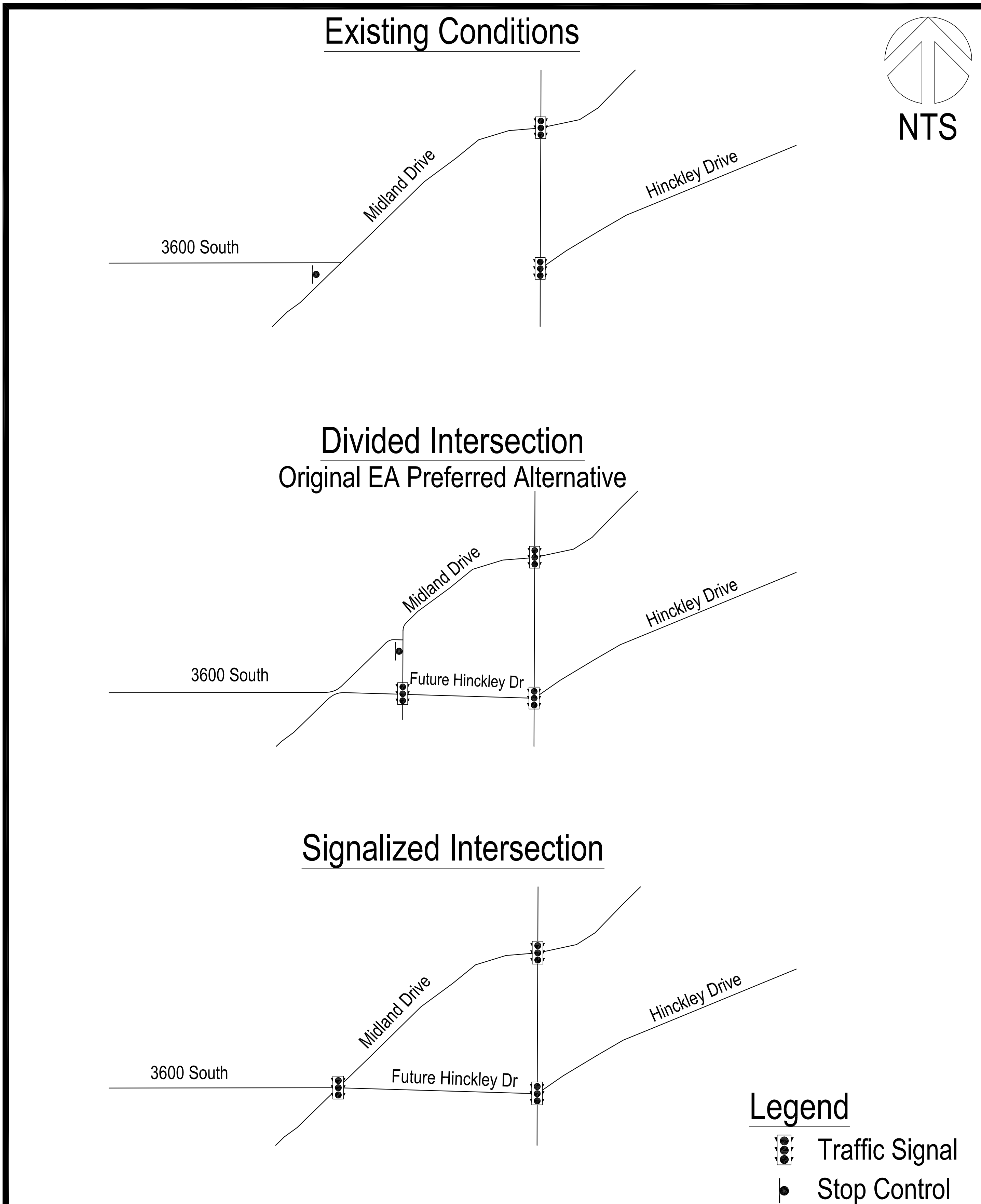
Executive Summary

This study reviewed three alternatives for the Hinckley Drive Extension project, a no build alternative, an alternative that divided the Midland Drive / Hinckley Drive intersection and an alternative that had a signal at the Midland Drive / Hinckley Drive intersection. The analysis concludes that the most favorable option for traffic is the signal at Midland Drive / Hinckley Drive. The signalized option results in more delay at some study intersections, less at others and would decrease overall travel miles and travel hours on the system because it allows more direct routes. The divided intersection has slightly more consistent intersection operations, but at the expense of fewer vehicles served. The Divided intersection is also a viable alternative.



Project Vicinity
Weekday PM Peak Hour

Figure 1



Hinckley Drive / Midland Drive
Intersection Configuration Options

Figure 2

Project History

The original Environmental Assessment included a traffic study, which was summarized in the EA. The final traffic study is not currently available, except for the summary in the EA, which does not contain detailed traffic volume and lane configuration information and some files for the traffic analysis program Synchro, which may or may not be the files that were used in the final analysis. These Synchro files were developed in an earlier version of Synchro, and when they are run using the most recent version of Synchro, the results do not match what is shown in the EA summary. As a result, we have very little background to reach a full understanding of the concerns and data that are behind the original traffic study.

We also know that the original traffic analysis used the 1998 base year version of the Wasatch Front Regional Council (WFRC) travel demand model. Since the traffic study was completed, the WFRC model has been updated to reflect new socioeconomic data, merged with the Mountainland Association of Governments (MAG) travel demand model, recalibrated, and now runs on a different software platform.

The new WFRC model reflects a more current understanding of how land use and transportation are projected to change in the future. Both the prior study and this study have a 2030 horizon, but the current study has the benefit of an additional 5 years of work by planning organizations, a shorter threshold (23 vs. 28 years), and an additional 5 years of changes to traffic patterns with growth in the area since the original traffic study.

Analysis

Analysis Methodology

This analysis uses two distinct types of analysis software, travel demand modeling software, and intersection analysis software.

The travel demand model used for this analysis was developed by the Wasatch Front Regional Council and runs on Citilab's CUBE software platform. The current network has a base year of 2005. In travel demand modeling, one of the steps is to calibrate the model based on existing traffic volumes. The match of modeled volumes to the existing volumes varies from location to location within the model. The study area is an area within the model where the correlation between modeled and existing traffic volumes is high. This leads to a high level of confidence in the model results for this area.

Synchro 6 was used to analyze operations at the study intersections. Synchro 6 is a detailed analysis tool originally designed to assist in creating timing plans to synchronize traffic signals. Synchro also includes a version of the Highway Capacity Manual (HCM) 2000 analysis methodology that is the standard method used to evaluate intersection operations. The HCM 2000 methodology assigns a Level of Service (LOS) from A (low delay) to F (high delay) based on a calculation of the seconds of delay per vehicle due to traffic control at the intersection. The delay calculation is the primary measure that is used from the HCM methodology, but the methodology also includes a calculation of the volume to capacity (V/C) ratio for the intersection. The V/C calculates what percentage of the total capacity of the intersection is being used by the proposed demand. The V/C ratio is less commonly used than delay (particularly in Utah), but we have included it in this report since it is an easier way to evaluate how much additional capacity an intersection has compared to looking at the intersection delay.

Existing Conditions

An assessment was made of the existing conditions in the study area. The study roadways are described below and can be seen in Figure 1.

- **1900 West (SR-126)** is a major five-lane, north-south corridor in Weber County and is classified as a minor arterial roadway. This roadway is used to access I-15, the Ogden metropolitan area, and many commercial areas surrounding the project area. Traffic will be redistributed along Midland Drive and onto the new Hinckley Drive extension, bypassing 1900 West between 4000 South and Hinckley Drive.

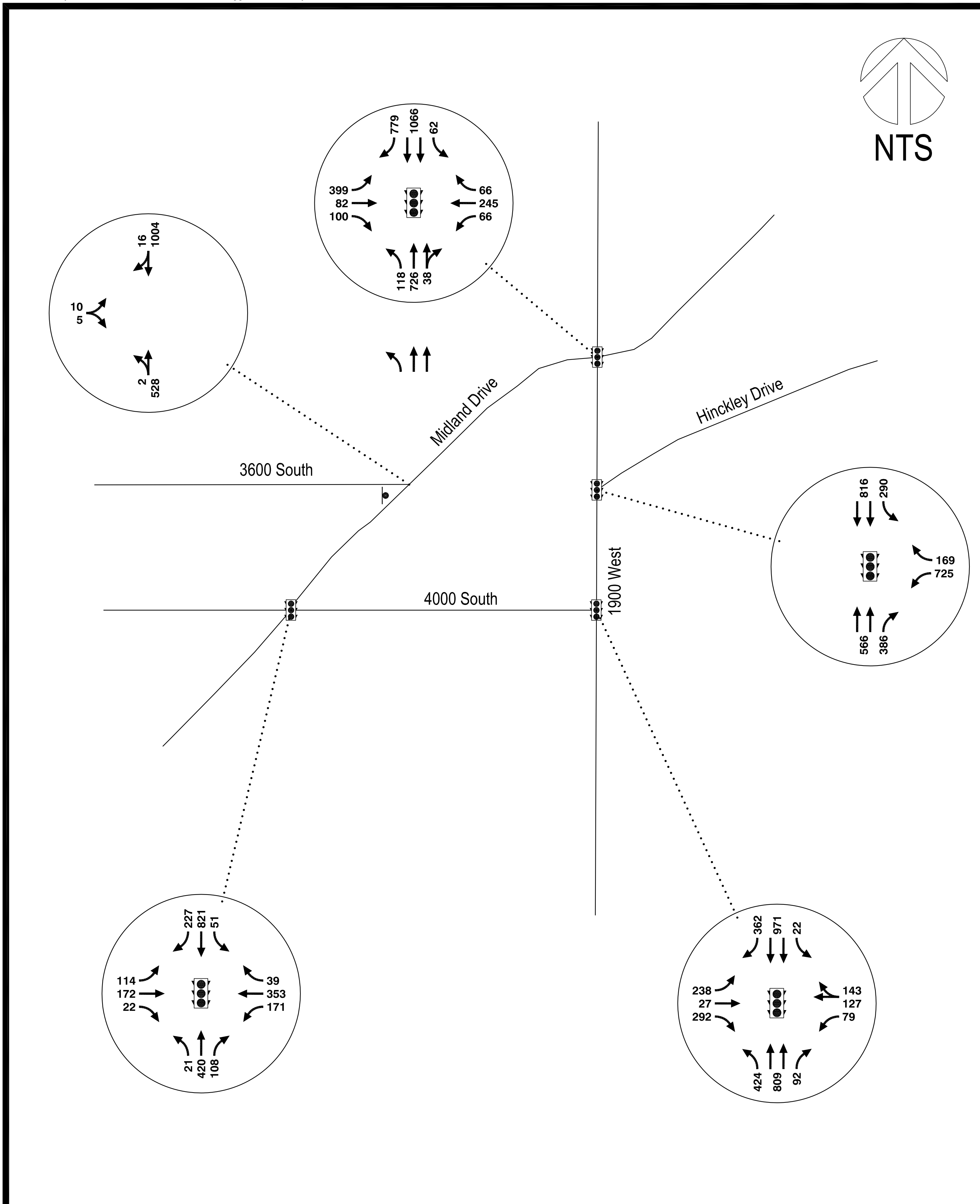
- **4000 South** is classified as a collector roadway with one lane in each direction. The eastern terminus of 4000 South is 1900 West. East-bound traffic using this roadway to access I-15 or the Ogden area must use either Midland Drive or the existing Hinckley Drive via 1900 West.

- **Midland Drive** is classified as a collector roadway. Midland Drive begins at 3500 West in West Haven City and runs northeasterly crossing 1900 West and I-15 before turning into 24th Street in Ogden. This roadway is a major connecting route between southwestern Weber County and the Ogden metropolitan area.

- **Hinckley Drive** is classified as a minor arterial roadway. Hinckley Drive begins in Ogden at Wall Avenue and runs westward, crossing I-15 before terminating at 1900 West. There is an existing interchange on Hinckley Drive at I-15, also known as the 31st Street interchange.

Intersection turning movement counts were conducted in December 2007 for the weekday p.m. peak period (4-6 p.m.) at the study intersections.

The existing turning movements are shown in Figure 3, and can also be found in Appendix A. The existing turning movements were used to develop the model turning movements.



2007 Existing Traffic Volumes Weekday PM Peak Hour

Figure 3

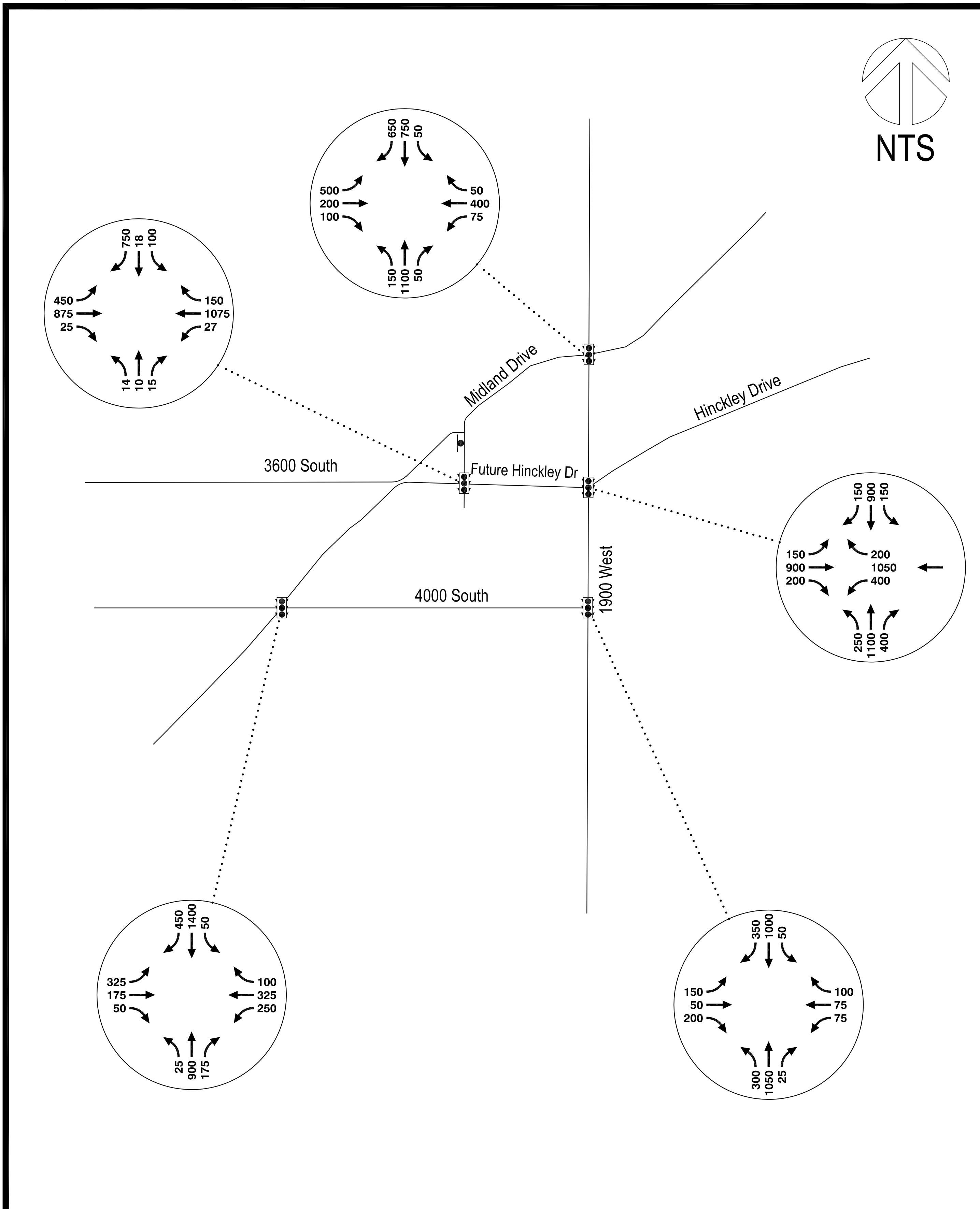
2030 Original EA Volumes

The 2030 Original EA volumes are taken from the original document and do not represent the current model. These volumes are presented to give a sense of how the projected volumes have changed based on more current information. The original EA volumes are shown in Figure 4. The original EA volumes are in some cases lower than the existing intersection counts. This suggests that development patterns have changed or developed in different ways from what was anticipated in the original EA.

Model Analysis

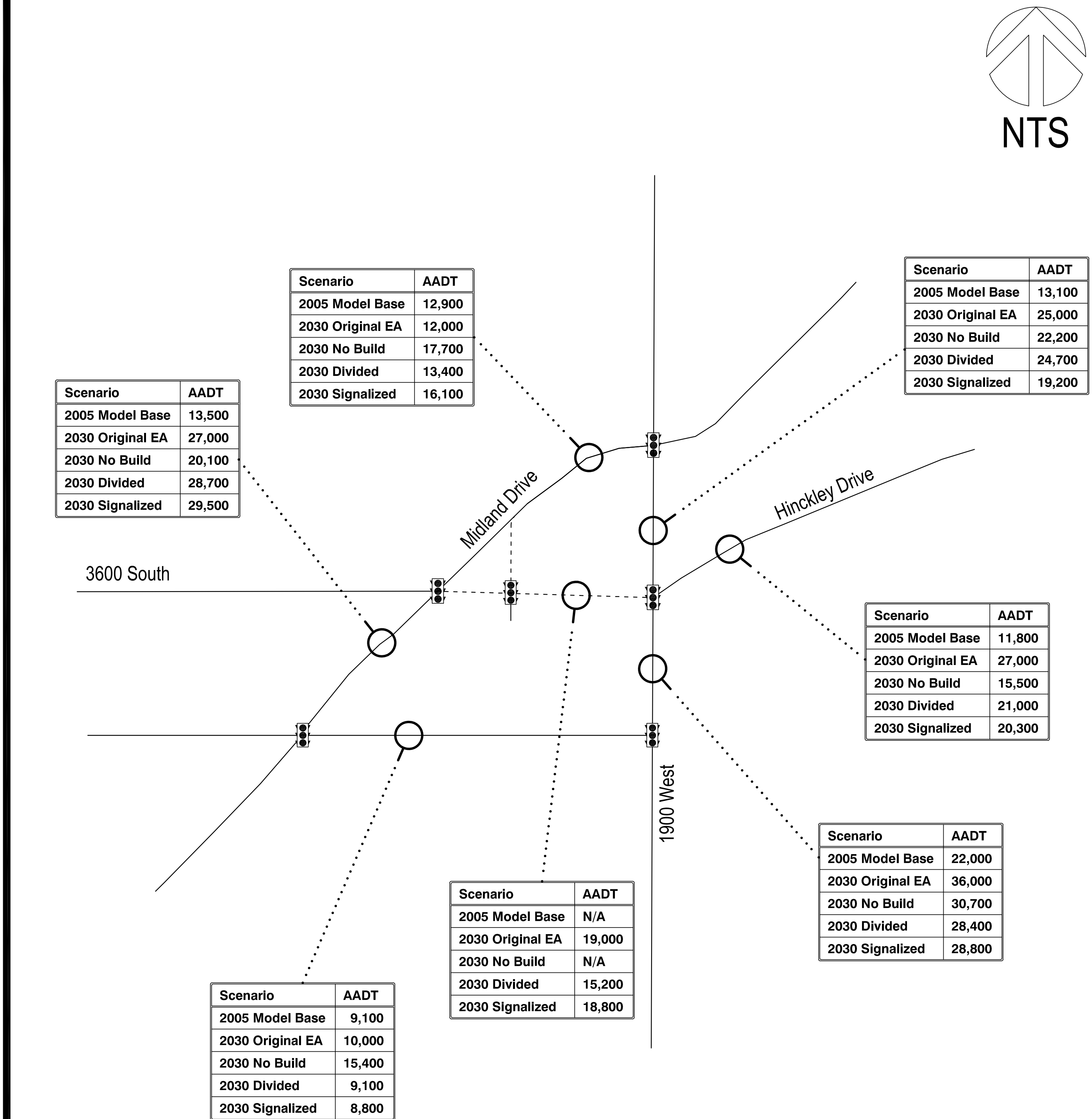
The travel demand model for 2030 was run with three different roadway configurations, the no build scenario, the divided intersection scenario and the signalized intersection. In addition, there are two scenarios that did not require model runs, the 2007 existing conditions (data from counts) and the original EA preferred alternative 2030 projected volumes. The model outputs consist of daily traffic volumes and peak period (3 hour peak) volumes. The Average Annual Daily Traffic (AADT) volumes for the three model runs and the 2005 traffic model base year are summarized in Figure 5, along with the volumes from the original EA document.

The weekday p.m. peak period results from the model runs were used to generate forecasts of turning movement volumes methodologies from National Cooperative Highway Research Program (NCHRP) documents 187, 255, and 387. The turning movement results for the 2030 No Build, Divided Intersection and Signalized intersection alternatives are shown later in the report with their respective intersection analysis. The total entering volumes for the study intersections for the five cases are compared in Table 1. As shown in the table, the existing traffic volumes at the 1900 West / 4000 South have already exceeded the 2030 projection from the previous EA.



2030 Original EA Preferred Alternative Weekday PM Peak Hour Traffic Volumes

Figure 4



Scenario	AADT
2005 Model Base	12,900
2030 Original EA	12,000
2030 No Build	17,700
2030 Divided	13,400
2030 Signalized	16,100

Scenario	AADT
2005 Model Base	13,100
2030 Original EA	25,000
2030 No Build	22,200
2030 Divided	24,700
2030 Signalized	19,200

Scenario	AADT
2005 Model Base	13,500
2030 Original EA	27,000
2030 No Build	20,100
2030 Divided	28,700
2030 Signalized	29,500

Scenario	AADT
2005 Model Base	11,800
2030 Original EA	27,000
2030 No Build	15,500
2030 Divided	21,000
2030 Signalized	20,300

Scenario	AADT
2005 Model Base	22,000
2030 Original EA	36,000
2030 No Build	30,700
2030 Divided	28,400
2030 Signalized	28,800

Scenario	AADT
2005 Model Base	N/A
2030 Original EA	19,000
2030 No Build	N/A
2030 Divided	15,200
2030 Signalized	18,800

Scenario	AADT
2005 Model Base	9,100
2030 Original EA	10,000
2030 No Build	15,400
2030 Divided	9,100
2030 Signalized	8,800

AADT Volumes

Figure 5

Table 1: Total Entering Volume Comparison

Intersection	Total Entering Volume Weekday PM Peak Hour				
	2007 Existing	2030 Original EA	Updated Model Runs		
			2030 No Build	2030 Divided Intersection	2030 Signalized Intersection
SR-126 (1900 West) / SR-108 (Midland Drive)	3,747	4,075	5,589	5,381	5,601
SR-126 (1900 West) / SR-79 (Hinckley Drive)	2,952	5,850	4,370	5,722	5,765
SR-126 (1900 West) / SR-37 (4000 South)	3,586	3,425	5,014	4,144	4,287
SR-108 (Midland Drive) / 3600 South (Future Hinckley)	1,565	3,509	2,154	3,483	4,354
SR-108 (Midland Drive) / SR-37 (4000 South)	2,569	4,225	3,979	3,982	4,511
Total Volume at Study Intersections*	14,419	21,084	21,106	22,712	24,518

*This quantity has no physical meaning, but is shown for illustrative purposes

As shown in Table 1, the total volume will increase significantly in all projected 2030 scenarios; however, the volume at one of the study intersections is greater in 2007 existing conditions than under the 2030 Original EA. The updated model does not have this drawback, which suggests that the original traffic projections have been overtaken by ongoing changes and development since the original EA.

The other interesting thing in Table 1 is the total volume at the study intersections. This quantity has no physical meaning – but it does illustrate something about the study. The total volume entering the study intersections is fairly consistent for all 2030 scenarios except the signalized intersection, where the volume jumps up by almost 10 percent. This suggests that the signalized intersection is somehow creating more traffic, or at least serving more traffic. The travel demand model demonstrates that the latter is the case – the study intersections serve more traffic under the signalized alternative, but the overall travel distance and travel time is reduced.

The travel demand model generates measures of the total miles traveled, and an estimate of how many total hours of travel result. This is a less detailed measure of delay than the intersection specific results presented later in this report, but it captures the total delay on the system, and shows delay displaced away from the study intersections. The model run data includes the total vehicle miles and hours projected for all of Weber County – which is a very large number. To simplify the results, Table 2 shows the difference between the no build model run and the two build alternatives, plus a summary of the difference between the two build alternatives.

Table 2: Vehicle Hours and Miles vs. No Build

	2030 No Build	2030 Divided Intersection	2030 Signalized Intersection	Additional Delay / Travel with Divided
Vehicle Hours Traveled per Day (difference from no build)	0*	+86	-40	+126
Vehicle Miles Traveled per Day (difference from no build)	0*	+10,126	+9,759	+367

*No build is baseline for this measure

As shown in Table 2, the signalized intersection has 126 less hours of travel per day and 367 less miles of total travel than the divided intersection preferred in the original EA. As noted above, the volumes to be analyzed in the signalized intersection alternative are higher than in the divided intersection alternative. Because the signalized intersection connects travel paths directly, the travel demand model shows fewer miles traveled and less delay, while more traffic is routed through the study intersections rather than elsewhere in the system.

2030 Traffic Conditions

2030 turning movement volume projections where created using the existing counts and data from the WFRC travel demand model. The travel demand model uses projected 2030 land uses to determine the demand for travel and then assigns the trips to the roadway network based on the available routes. The same land uses were used for all 2030 projections in this report, but with different roadway configurations representing the different alternatives. The alternatives studied are described below. The Synchro analysis results are summarized in Appendix B.

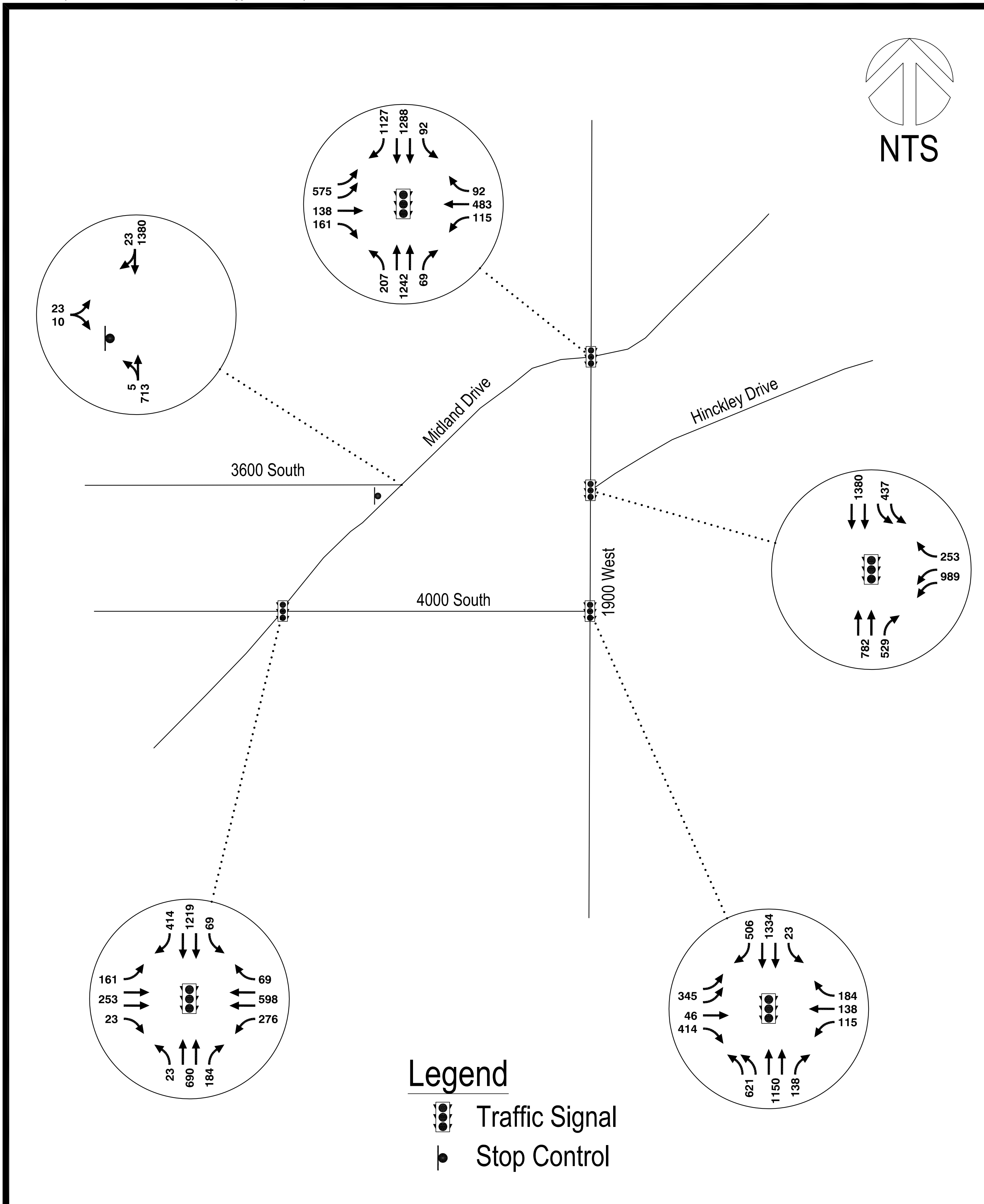
2030 No Build

The no build alternative is a look at what would happen if the project in question, the Hinckley drive extension were not built. The alternative does assume that other projects in the 2030 long-range plan are built. The lane configurations, traffic control devices and traffic volumes assumed for the 2030 no build project are shown in Figure 6. Table 3 summarizes the operational results from the 2030 no build analysis.

Table 3: 2030 No Build Traffic Operations

Intersection	Traffic Control	Delay (sec/veh)	LOS	V/C
SR-126 (1900 West) / SR-108 (Midland Drive)	Signal	127	F	1.36
SR-126 (1900 West) / SR-79 (Hinckley Drive)	Signal	17.8	B	0.86
SR-126 (1900 West) / SR-37 (4000 South)	Signal	58.8	E	0.98
SR-108 (Midland Drive) / 3600 South (Future Hinckley)	TWSC*	129	F	0.58
SR-108 (Midland Drive) / SR-37 (4000 South)	Signal	23.2	C	0.81

*TWSC = Two Way Stop Control – Delay, LOS and V/C are for critical movement



2030 No Build (Updated Demand Model
Weekday PM Peak Hour Traffic Volumes,
Lane Configurations and Traffic Control Devices

Figure 6

As shown in Table 3, the 2030 No Build alternative results in an LOS worse than D at three of the study intersections. It should be noted that the Midland / 3600 South intersection shows an LOS F, but this result is only for the critical (worst) movement. In this case, the critical movement is the eastbound shared left/right lane. The rest of the movements operate with minimal delay, and as a result, the overall delay at the intersection is minor. Because the total delay at the Midland / 3600 South intersection is less than would be experienced with a traffic signal at this location, the intersection is unlikely to warrant a signal under the projected no build volumes. Because the critical movement at the intersection is under capacity, this is an acceptable operating condition.

2030 Divided Intersection

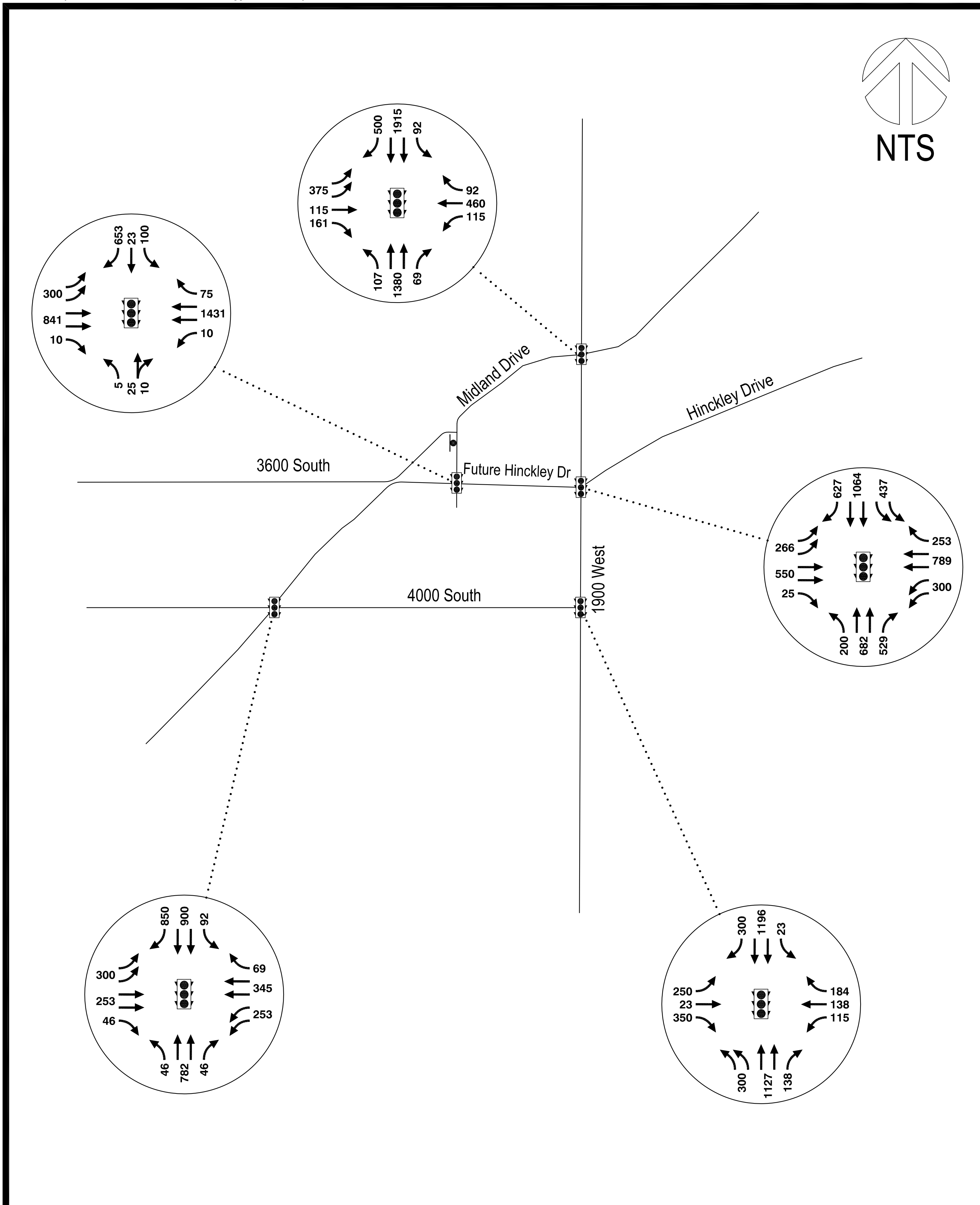
The original EA's preferred alternative created a divided intersection where the Hinckley extension terminated at the existing 3600 South / Midland Drive intersection. Under this alternative, Hinckley Drive connected to Midland Drive south of 3600 South, while 3600 South connected to Midland on its alignment to the north (see Figure 2 for a schematic view of the proposed alignment). This intersection essentially eliminated all delay at the western end of the Hinckley Drive extension at the expense of providing access from Hinckley directly to 3600 South and along Midland Drive from north to south.

These analysis results are for updated traffic projections. The number of through lanes on each roadway is consistent with the latest planned lanes outside of Hinckley Drive, and the Hinckley Drive number of through lanes is consistent with the original EA document. The turning lane configurations were adjusted at the intersections to provide the best match for the updated volumes, without changing the planned through lanes. The lane configurations, traffic control devices and volumes for the divided intersection alternative are shown in Figure 7. The analysis results are summarized in Table 4.

Table 4: 2030 Divided Intersection Traffic Operations

Intersection	Traffic Control	Delay (sec/veh)	LOS	V/C
SR-126 (1900 West) / SR-108 (Midland Drive)	Signal	78.0	F	1.08
SR-126 (1900 West) / SR-79 (Hinckley Drive)	Signal	43.2	D	0.84
SR-126 (1900 West) / SR-37 (4000 South)	Signal	42.1	D	0.74
SR-108 (Midland Drive) / 3600 South (Future Hinckley)	Signal	34.6	C	0.91
SR-108 (Midland Drive) / SR-37 (4000 South)	Signal	37.6	D	0.74

As shown in Table 4, the 1900 West / Midland Drive intersection is projected to operate at LOS F and a V/C greater than 1.0, but better than it did under no-build conditions. The rest of the study intersections operate acceptably.



2030 Divided Intersection
Weekday PM Peak Hour Traffic Volumes,
Lane Configurations and Traffic Control Devices

Figure 7

2030 Signalized Intersection

As the previous EA was reviewed, there was a strong sense that to have Hinckley Drive and Midland Drive not connect as directly as possible was not logical. To connect more directly also improves local access. The purpose of this analysis is to test whether or not a direct connection is feasible and beneficial. The lane configurations, traffic control devices and volumes for the signalized intersection alternative are shown in Figure 8.

Table 5: 2030 Signalized Intersection Traffic Operations

Intersection	Traffic Control	Delay (sec/veh)	LOS	V/C
SR-126 (1900 West) / SR-108 (Midland Drive)	Signal	129	F	1.33
SR-126 (1900 West) / SR-79 (Hinckley Drive)	Signal	50.0	D	0.91
SR-126 (1900 West) / SR-37 (4000 South)	Signal	27.7	C	0.86
SR-108 (Midland Drive) / 3600 South (Future Hinckley)	Signal	33.4	C	0.91
SR-108 (Midland Drive) / SR-37 (4000 South)	Signal	29.6	C	0.94

As shown in Table 5, all intersections operate acceptably with the exception of the 1900 West / Midland drive intersection, which is projected to operate at LOS F with a V/C ratio greater than 1.0. Three of the five study intersections are expected to operate with slightly less delay than the divided intersection alternative, which is counter-intuitive, since the study intersections are carrying more traffic, as reflected in the V/C results. With the signalized alternative the routes are more direct, and as a result the traffic volumes are more conducive to efficient signal operations.

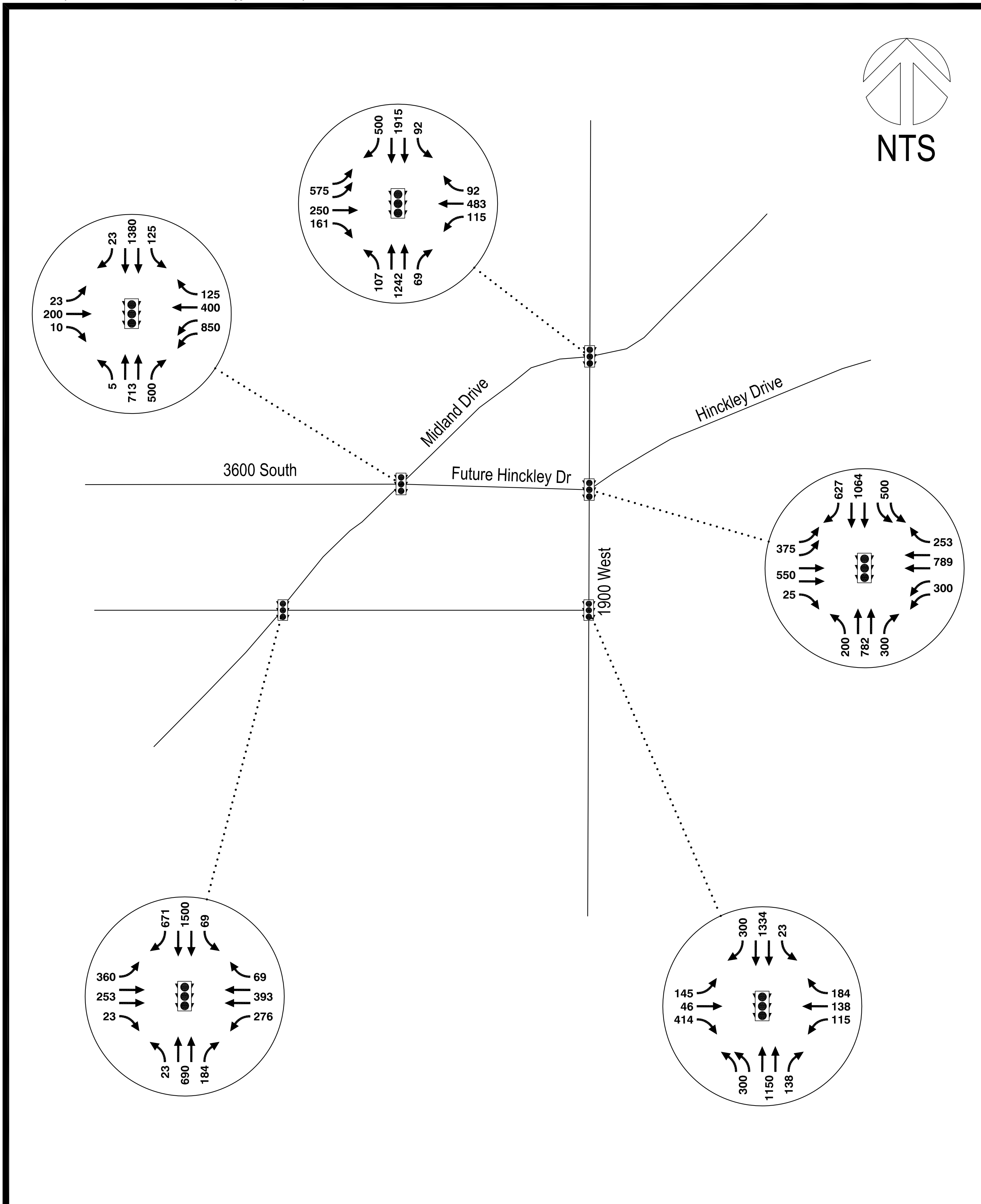
The two intersections with more delay are carrying more traffic than they do in the divided intersection alternative. The signalized alternative may allow more direct routes, but those direct routes result in more traffic at the two study intersections farther north on 1900 West and create the need for additional capacity at the 1900 West / Midland Drive intersection.

Alternatives Discussion

The no-build alternative shows significant delay and/or capacity failures at a majority of the study intersections. It also significantly decreases the number of miles traveled – about 10,000 less than either build alternative, while changing the total travel time relatively little (that is, it takes the same to travel much less total distance).

The divided intersection alternative has better operations at the two highest delay study intersections, but it does so by diverting traffic away from those study intersections – the travel demand model shows 367 miles and 126 additional hours of travel per day. It also has higher levels of delay at three of the study intersections.

The signalized intersection alternative has better operations at three of the five study intersections than the divided intersection alternative, and it also serves about 10% more traffic at the study intersections. The travel demand model shows that the signalized intersection alternative lowers the number of vehicle miles and hours traveled.



2030 Signalized Intersection
Weekday PM Peak Hour Traffic Volumes,
Lane Configurations and Traffic Control Devices

Figure 8

Conclusions

After reviewing the alternatives, the signalized intersection has the best effect on the overall system, serving more traffic at the study intersections, and reducing vehicle miles and hours traveled in the study area. The divided intersection has more balanced operations at the study intersections, but at the expense of serving less traffic. Either alternative would be a reasonable one, but this study suggests the signalized intersection as the most direct and logical approach to mobility and access in the study area.

Finally, it should be noted that traffic operations is only one component of the EA process. There are many other considerations that have been dealt with in other parts of the process.

Appendices

Appendix A: Traffic Count Data
Appendix B: Traffic Analysis Results